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GHOST TREES OF YOSEMITE

G.R.STRUBLE
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FOREST INSECT LABORATORY,
UNIVERSITY OF CALIFORNIA,
BERKELEY, CALIFORNIA.

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According to an early Indian legend, when the world was made a great Ghost tore the heart out of Kay-o-pha, the Sky Mountains and left the gash unhealed. This gash is known today as Yosemite Valley. Ghosts still persist in the areas surrounding Yosemite Valley, not as unseen beings, but as real skeletons in the form of wierd-looking, white, polished dead trees. Ghost forests of lodgepole pine are found in the upper watersheds of the Tuolumne River and Tenaya Creek. This spectacle is familiar to thousands of tourists who have within recent years travelled along the Tioga road. The best examples are located at Lake Tenaya; Jack Main, Matterhorn, and Stubblefield canyons; Smoky Jack Meadow; Cathedral Creek.

What killed these trees? How long have they been dead? These questions have been asked many times by tourists travelling through these dead forests. Until investigations were made, the cause was generally attributed to fire. In a book entitled "Yosemite Trails", published by J. Smeaton Chase a well-known author, in 1911, a description is found on page 74 as follows:

> "There is a melancholy amount of dead timber throughout this region. Long stretches of tamerack forests have perished as if at a stroke. Close examination shows that they have been destroyed by fire, although the polished skeletons would seem to indicate almost any other agency".

As early as 1907 insects were suspected to be the cause of damage. Not until intensive studies were made, following the re-opening of the Tioga road, around 1912, to motor travel was it found that insects were definitely responsible.

The Tioga road was constructed between 1882 and 1883 by the Great Sierra Mining Company. At this time green forests of lodgepole lined the route. Due to financial troubles, mining operations ceased in 1884, following which the road was not maintained, but used only as a horse trail. Because of the difficulties to be encountered, few persons other than rangers, cattle, and sheep men penetrated the desolate areas until after the road was re-opened to public travel. So far as any records of kill are concerned the first occurred around the early "nineties", and were present at the time Yosemite was set aside as a National Park. Ranger Leonard, engaged in driving trespassing Basque sheepherders and their flocks from the northern limits of the Park in 1898 reported a stand of dead trees centering in Jack Main canyon. These trees, he said, had been dead for several years.

Slide 1

This photograph of a dead forest between Lake Tenaya and Tuolumne Meadows is representative of the conditions found after 1912, when the first regular investigations were made by the Bureau of Entomology. Annual records taken since then have shown definitely that the transition from healthy stands of green trees to a ghost forest is a sudden affair. One of

the most recent killings dates between 1917 and 1922, at Snow Flat along the Tioga road. In 1917 the forest took on a sickly looking appearance; by 1922 it was reduced to a stand of ghosts such as the one illustrated here.

Slide 2

A close-up of this same stand showing the skeleton-like appearance of polished snags. Very few young trees have grown up to replace the dead ones. The fire scars on the bases of some of the trees showing in the foreground were caused when the Tioga road was re-opened. Had this stand of timber been killed by fire it would have shown up in this photograph as a blackened mass of snags. Every one of these trees upon close examination bears the marks of insects engraved on the polished trunks.

Slide 3

The insect primarily responsible for the damage is known as the mountain pine beetle, an inset of which is shown in the upper left corner of the panel. It is an insignificant looking, small, coal-black bug, smaller in size than an ordinary house fly, and is capable of flying long distances. It kills trees by working in large numbers between the bark and wood in such a manner to cut off the sap flow. When the beetle first enters a tree it bores through the bark. In so doing it must overcome the flow of pitch which it pushes to the outside, mixed with frass material and borings. This accumulates as a pitch mound or pitch tube on the outer bark. Many of these pitch tubes are shown in the photograph to the left of a newly attacked lodgepole pine. Pitch tubes such as shown here are the first signs of a successful beetle attack. Beneath the bark the beetle constructs long vertical egg galleries, some of which attain a length of 3 or 4 feet. The center photograph illustrates several of these galleries engraved on the sapwood surface, the bark having been removed. On each side of the egg galleries many eggs are deposited which hatch within a few days to small worm-like grubs or larvae. The lower left illustration shows the inner surface of a piece of bark with larvae scattered over it. Egg galleries, larval mines are clearly shown. The arrow at "B" points to a pupa, a stage in the transformation from larvae to adult. One generation of this insect develops each year in these ghost forests.

Slide 4

How is it possible to know that these ghost trees were killed by the mountain pine beetle? Without exception the work of this insect is engraved on the weathered skeletons of every one of these trees. This illustration is a close-up of the egg galleries and larval mines scattered over the surface. Some idea of the size of egg galleries is gained by comparison with the pocket knife in the upper left hand corner.

Slide 5

This photo was taken before the Tioga road was re-opened and the only access to the areas was by means of horseback. The removal of a mass of fallen snags for miles was necessary before the road could be opened to travel.

Slide 6

The re-opening of the Tioga road enabled motorists to see these dead forests for the first time. This scene is typical of the conditions found around 1914. Many of these snags are still standing.

Slide 7

Another view along the Tioga road near Lake Tenaya. For several years, following a sudden killing, there remains only a desolate looking stand of whitened tree trunks and scrawny branches, until the areas are gradually replaced by young undergrowth. The green forest in the background consists of fir and hemlock both of which are immune to the attacks of the mountain pine beetle.

Slide 8

Another view a short distance off the Tioga road showing the open condition left. This photograph taken in 1924, shows the beginning of an understory of young trees. This photograph, as well as the two preceding this one were taken between 1912 and 1924. Since that time a dense jungle of young lodgepole pine trees has grown up, mixed with fallen snags, making penetration through it impossible. Such a condition has caused a very serious fire hazard, to say nothing of the effect caused by cutting off the view from the road.

Slide 9

Campground sites are sometimes ruined in a single year as a result of an agressive attack of the mountain pine beetle. This photograph shows one of these campground sites in the upper elevations of Yosemite National Park which in one season was reduced to a mass of dead trees ruining the area for any further use as a camping site.

Slide 10

Ghost trees not only apply to lodgepole pine devastations. Many of the largest sugar pines are victimized by the mountain pine beetle and reduced to dead snags within a short period. Devastations to sugar pine stands are never as spectacular as the widespread killing of lodgepole forests because of the scattered admixture of sugar pines with other forest tree species. Nevertheless the annual volume loss of sugar pine is enormous. This photograph was taken of a group of sugar pine ghosts a few miles south of Mariposa Grove.

Slide 11

Dr. Hopkins, known as the father of Forest Entomology in America and the first Chief of the Division of Forest Insects, visited Yosemite National Park in 1904. While travelling along the Alder Creek Trail between Glacier Point and Wawona he photographed these old sugar pine snags. He was tremendously impressed by the great size of these trees and especially by the

destruction of the mountain pine beetle, which had killed them. This photograph has historic interest. It was used as an illustration in the first bulletin printed on tree destroying bark beetles. Some idea of the size of these trees is gained by the comparison with the horse and Ranger Leiding who accompanied Dr. Hopkins on this trip.

Slide 12

The tops of these same trees. The tree on the right was killed several years after the others, as evidenced by foliage still clinging to the upper branches and the bark still clinging to the main trunk. Note that the bark has fallen from the two trees on the left, indicating a state of decadence. Sugar pines do not stand for a period much longer than 10 years after they have been killed due to the rapid progress of fungus rots.

Slide 13

Before sugar pines become "Ghosts" they look like this. The tree on the right has turned yellowish for half its length. What causes this? The mountain pine beetle, working between the bark and wood opposite the fading branches has cut off the sap flow to the foliage, which has begun to dry out. The drying and dying condition has caused the green coloring matter to disappear, giving rise to yellows, which will turn gradually later on to reddish brown, dark brown, and black. The green portion of this tree indicates the beetle has not yet invaded the lower portion of the trunk. Since this photograph was taken the entire tree was killed. The tree on the left was killed one year before the tree on the right as evidenced by the brownish color of the foliage.

Slide 14

During an epidemic of the mountain pine beetle many sugar pines are killed, scattered throughout the forest. This photograph illustrates an area of timber lying along the west boundary of Mariposa Grove which was attacked during one of these epidemics in 1932. An enormous volume of sugar pine trees was killed during that year.

Slide 15

This tree was felled to destroy the broods lying beneath the bark during insect control. The great size and age of this tree so impressed Ranger Adair standing near the butt, that he inscribed the writing on the cut end. This tree stood for nearly 400 years and was killed by insects in one year. The control of pine bark beetles is now commonly practiced in the National Parks.

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The subject of insect control is one of interest and is worthy of a separate discussion, which I hope can be taken up at some time in the near future

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Whether to protect lodgepole and sugar pine stands, on the one hand, or leave them to the destructive tendencies of the beetles, on the other, are questions both of which have points of merit. The presence of beautiful stands of old enormous sugar pines is a definite asset to the Park. In contrast to this is the wierd spectacle presented by a mass of dead trees. Both are natural phenomena. Some regard ghost forests as beautiful, others shudder at such destruction. The fact remains that "Ghost" trees may still be seen by those who choose to travel through Yosemite National Park, but within a few years they may be a thing of the past.

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Lecture Presented "Toastmasters"
February 20, 1936
G. R. Struble